

CLAIMS

What is claimed is:

- 1 1. A method, comprising:
 - 2 directing an optical beam into a first end of an optical path having the first end and a
 - 3 second end disposed in a semiconductor substrate;
 - 4 reflecting a first portion of the optical beam having a first center wavelength back out
 - 5 from the first end of the optical path; and
 - 6 tuning the optical path to reflect a second portion of the optical beam having a second
 - 7 center wavelength back out from the first end of the optical path.
- 1 2. The method of claim 1 further comprising confining the optical beam to remain
- 2 within the optical path between the first and second ends with an optical waveguide disposed
- 3 in the semiconductor substrate between the first and second ends.
- 1 3. The method of claim 1 wherein tuning the optical path comprises adjusting an
- 2 effective index of refraction of the optical path through the semiconductor substrate along the
- 3 optical path.
- 1 4. The method of claim 1 wherein tuning the optical path comprises adjusting a
- 2 temperature of the semiconductor substrate with a heater disposed proximate to the optical
- 3 path through the semiconductor substrate.

1 5. The method of claim 1 wherein tuning the optical path comprises modulating
2 charge in the optical path through the semiconductor substrate in response to a modulating
3 signal.

1 6. The method of claim 5 wherein in modulating charge in the optical path comprises
2 modulating a voltage of the modulation signal applied to a conductive element of a
3 conductor-insulator-semiconductor structure included along the optical path.

1 7. The method of claim 1 wherein reflecting the first portion of the optical beam
2 comprises perturbing an effective index of refraction a plurality of times along the optical
3 path to form a Bragg grating.

1 8. The method of claim 7 wherein perturbing the effective index of refraction the
2 plurality of times along the optical path comprises periodically or quasi-periodically
3 disposing silicon and polysilicon in the semiconductor substrate along the optical path.

1 9. The method of claim 7 wherein perturbing the effective index of refraction the
2 plurality of times along the optical path comprises periodically or quasi-periodically
3 changing a geometry of the optical path along the optical path.

1 10. An apparatus, comprising:
2 a semiconductor substrate;

3 a heater disposed proximate to the semiconductor substrate;
4 an optical path through the semiconductor substrate, wherein a temperature of the
5 semiconductor substrate including the optical path is responsive to the heater; and
6 a plurality of perturbations of a refractive index of the semiconductor substrate along
7 the optical path, the refractive index of the semiconductor substrate responsive to the
8 temperature of the semiconductor substrate.

1 11. The apparatus of claim 10 further comprising an optical waveguide disposed in
2 the semiconductor substrate, the optical waveguide including the optical path.

1 12. The apparatus of claim 11 wherein the optical waveguide disposed in the
2 semiconductor substrate comprises an optical rib waveguide.

1 13. The apparatus of claim 10 further comprising:
2 a first optical confinement layer disposed proximate to the semiconductor substrate
3 layer; and
4 a second optical confinement layer disposed proximate to the semiconductor substrate
5 layer such that the semiconductor substrate layer is disposed between the first and second
6 optical confinement layers.

1 14. The apparatus of claim 13 further comprising a second semiconductor substrate
2 layer disposed proximate to the second optical confinement layer such that the second optical
3 confinement layer is disposed between the semiconductor substrate layer and the second
4 semiconductor substrate layer.

1 15. The apparatus of claim 14 wherein the semiconductor substrate, the second
2 semiconductor substrate, the first optical confinement layer and the second optical
3 confinement layer are included in a silicon-on-insulator wafer.

1 16. The apparatus of claim 10 wherein the plurality of perturbations of the refractive
2 index of the semiconductor substrate along the optical path are provided with periodic
3 regions of silicon and polysilicon disposed in the semiconductor substrate along the optical
4 path.

1 17. The apparatus of claim 16 wherein the periodic regions of silicon and polysilicon
2 provide a uniform Bragg grating disposed in the semiconductor substrate.

1 18. The apparatus of claim 10 wherein the plurality of perturbations of the refractive
2 index of the semiconductor substrate along the optical path are provided with quasi-periodic
3 regions of silicon and polysilicon disposed in the semiconductor substrate along the optical
4 path.

1 19. The apparatus of claim 18 wherein the quasi-periodic regions of silicon and
2 polysilicon provide an apodized Bragg grating disposed in the semiconductor substrate.

1 20. The apparatus of claim 10 wherein the heater comprises a thin-film heater.

1 21. An apparatus, comprising:

2 a semiconductor substrate;

3 an optical path through the semiconductor substrate; and

4 a plurality of perturbations of a refractive index of the semiconductor substrate along

5 the optical path; and

6 a plurality of charge modulated regions disposed in the optical path.

1 22. The apparatus of claim 21 further comprising an optical waveguide disposed in

2 the semiconductor substrate, the optical waveguide including the optical path.

1 23. The apparatus of claim 22 wherein the optical waveguide disposed in the

2 semiconductor substrate includes an optical rib waveguide.

1 24. The apparatus of claim 21 further comprising:

2 an insulating layer disposed proximate to the semiconductor substrate; and

3 a plurality of conductive elements disposed proximate to the insulating layer such that

4 the insulating layer is disposed between the plurality of conductive elements and the

5 semiconductor layer, the plurality of conductive elements coupled to receive a modulation

6 signal, the plurality of charge modulated regions coupled to be modulated in response to the

7 modulation signal.

1 25. The apparatus of claim 24 further comprising first and second optical

2 confinement layers, the semiconductor substrate disposed between the first and second

3 optical confinement layers, the first optical confinement layer including the insulating layer.

1 26. The apparatus of claim 21 wherein the plurality of perturbations of the refractive
2 index of the semiconductor substrate along the optical path are provided with periodic
3 changes in a geometry of the optical path in the semiconductor substrate along the optical
4 path.

1 27. The apparatus of claim 26 wherein the periodic regions of silicon and polysilicon
2 provide a uniform Bragg grating disposed in the semiconductor substrate.

1 28. The apparatus of claim 21 wherein the plurality of perturbations of the refractive
2 index of the semiconductor substrate along the optical path are provided with quasi-periodic
3 changes in a geometry of the optical path in the semiconductor substrate along the optical
4 path.

1 29. The apparatus of claim 28 wherein the quasi-periodic changes in a geometry of
2 the optical path provide an apodized Bragg grating disposed in the semiconductor substrate.